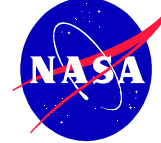# 2004 and 2005 Infusions of Software Engineering Research/Technology

Technology	Technology Provider	Technology Description	Customer Sites and Target Applications	Outcome/Benefits
Perspective-based Inspections	Fraunhofer Maryland, SARP	Software Manual Inspection Technique	**GSFC** (Spacecraft FSW) **USA** (ISS power analyzer)	Defects found in legacy code and that escaped previous inspections. Adopted.
Software Cost Reduction (SCR)	Naval Research Laboratory	Requirements Analysis Tools	**ARC** (ISS Payload)	Personnel trained. Some reqts validated.
SpecTRM	Safeware Engineering Corp. & MIT	Requirements Capture and Analysis	**JPL** (Capture of Mission Design Rationale)	Experiment was positive. MIT student hired.
Orthogonal-Defect Classification	JPL, SARP	Process Improvement Methodology	**JPL** (Ground SW)	SQA and project personnel trained.
CodeSurfer/CodeSonar	Grammatech, Inc.	Reverse Engineering/defect detection	**JSC** (ISS, Shuttle), **IVVF** (Spacecraft FSW)	Found defects that escaped previous inspections.
C Global Surveyor (CGS)	ARC – Intelligent Systems Program	Software assurance tool	**ARC** (ISS science payload) **MSFC** (ISS payload)	Found defects. Good feedback to provider.
Coverity SWAT/Prevent	Coverity, Inc.	Software defect detection tool	**MSFC** (ISS, Shuttle FSW)	Found defects that escaped testing. Will be adopted.
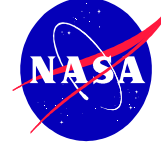
2006 Infusion Starts

Technology	Technology Provider	Technology Description	Customer Sites and Application
Design Advisor	Siemens Corporate Research	UML style checker	**GSFC** (Spacecraft Science Instrument Module)
Software Architecture Evaluation	Fraunhofer Maryland	Code/Architecture Consistency Analysis	**JHU/APL** (Ground SW)
Klocwork Inspect	Klocwork, Inc.	Software defect detection tool	**JPL** (Ground SW), **GSFC** (FSW)
CodeSurfer	Grammatech, Inc.	Reverse Engineering/defect detection	**KSC** (Shuttle Processing CY06) **GRC** (ISS FSW)
CASRE	JPL	Software reliability estimation	**JPL** (Mission Planning)
RTLinux	FSMLabs	Real time operating system	**LaRC** (FSW demo)
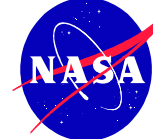
Software Engineering Research Infusion

Technologies and Infusion sites: Applications:

C code analysis (**JHU/APL, ARC, GSFC, IVVF, JPL, KSC, MSFC**) Flight & Ground SW

Manual inspection technique (**GSFC, USA**)   ISS, Spacecraft FSW

Defect classification (**JPL**)   Ground SW

Requirements analysis tool (**ARC**)   ISS payload

UML checking (**GSFC**)   Spacecraft science instrument

Real-time OS (**LARC**)   FSW demo
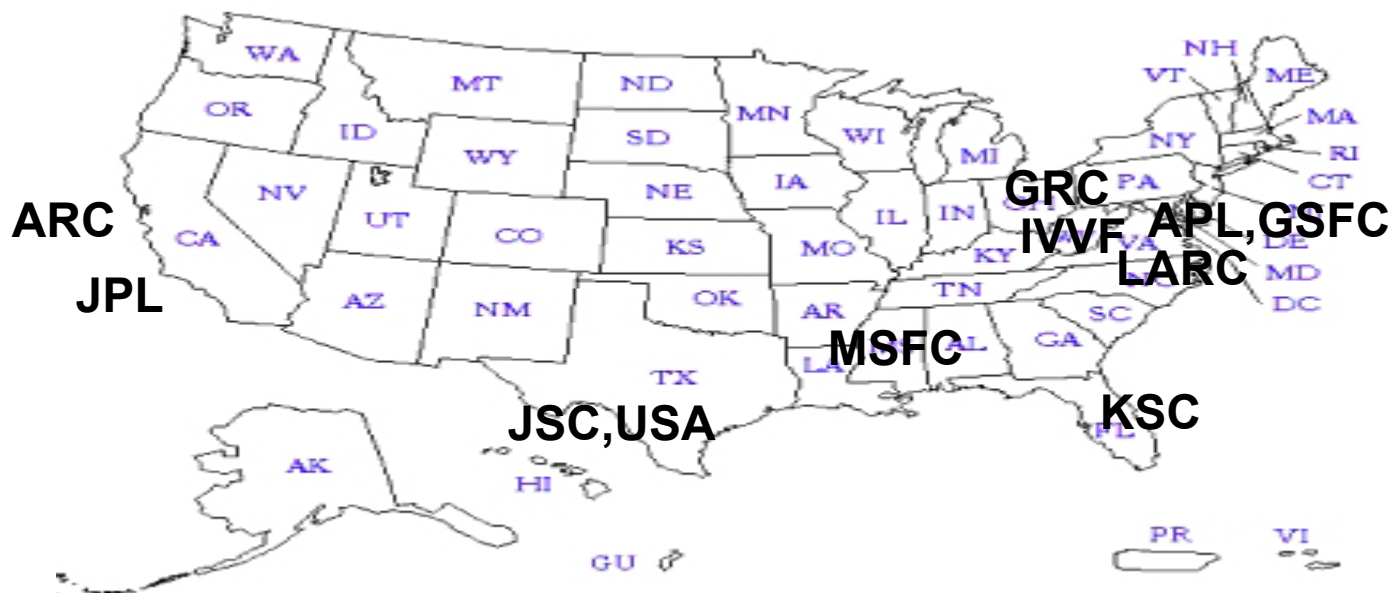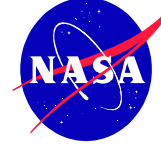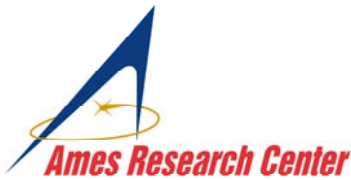
Infusion of Software Engineering Research

- **POC:** Tom Pressburger (Robust Software Engineering (RSE) Group, Code TI, tom.pressburger@nasa.gov)
    Lawrence Markosian (RSE Group, QSS Group, Inc., Code TI, markosian@email.arc.nasa.gov)
- **Funding:** Office of the Chief Engineer (OCE) and Office of Safety and Mission Assurance's Software Assurance Research Program (OSMA SARP)
- **Highlight:** The software engineering technology infusion pilot projects that the Research Infusion subgroup of the intercenter Software Working group helped start have yielded benefits to NASA software development projects. Example benefits were detection of software defects that occurred in legacy code, or had escaped previous inspections and testing. Also, the development projects gave useful feedback to the technology developers and NASA about deployment concerns. Some of the technologies that were piloted have been adopted for future use by the projects. Technology transfer is a difficult task, and the subgroup seems to have found an inexpensive approach to introducing certain kinds of technologies. Tom Pressburger presented the approach of the subgroup to starting these pilot projects and the progress of the first two rounds of pilots at the Office of Safety and Mission Assurance's (OSMA) Software Assurance Symposium in August 2005 in Morgantown, WV (http://sas.ivv.nasa.gov/). In the audience were S&MA center directors, and OSMA chief officer Bryan O'Connor encouraged John Kelly of the Office of the Chief Engineer (OCE) to continue the Research Infusion subgroup. OSMA's Software Assurance Research Program (SARP) and the OCE accepted the subgroup's recommendations of pilots for its round of 2006 funding. The results of the pilots to date was also presented by Tom Pressburger at the Software Working Group meeting in Februrary 2006, and the new lead of the subgroup, Michael Hinchey, presented the pilots that will be started in 2006. A paper describing the subgroup's approach was accepted by the March 2006 IEEE Aerospace Conference in the "Technology Investment and Infusion" track and was presented by Lawrence Markosian. Activities of the Research Infusion subgroup are described at http://ti.arc.nasa.gov/researchinfusion/ .
- **Background:** The goal of the NASA Software Engineering Initiative (NSEI), led by the Office of the Chief Engineer, is to improve NASA software engineering to meet the challenges of NASA. One of the Initiative's objectives is to infuse mature software engineering research results into NASA practice. This task was assigned to the Research Infusion subgroup of the intercenter Software Working Group. The subgroup was led by Tom Pressburger with substantial contribution from Lawrence Markosian, and also had members Ben Di Vito (LaRC), Martin Feather (JPL), Michael Hinchey (GSFC), Tim Menzies (WVU, IVVF), and Luis Trevino (formerly of MSFC). The subgroup focuses on getting beneficial NASA-sponsored and related software engineering research and leading-edge commercial tools used on NASA software projects. The approach is to select promising technologies, publicize them across NASA in a ViTS (a video teleconference presentation), and initiate pilot projects (with funding in the range $20K to $50K from SARP and OCE) that deploy the technologies on NASA software development projects in collaborations between the NASA projects and the technology developers. The pilot projects are selected on the basis of proposals submitted by software developers on NASA projects. Six pilot projects, at ARC, GSFC, JPL, JSC, MSFC, and USA, resulting from the first ViTS were completed by early CY2005, and four new pilot projects, at ARC, GSFC, IVVF and JPL, were started in CY2005 in response to the second ViTS. Technologies deployed include formal inspections, code and model analysis tools (including CGS developed within the RSE group), and defect classification. Applications included ISS payloads and ground and flight software. The third ViTS, given 03/23/2005, publicized 14 technologies. In response, 18 proposals were received by the subgroup, and 7 pilots from across the agency will be funded by SARP and OCE in CY06.
- **Future Plans:** The subgroup will continue tracking the progress of the ongoing pilots. OSMA and OCE are continuing to support the technology infusion subgroup, despite a tight budget environment, under the new leadership of Michael Hinchey (GSFC). Tom Pressburger and Lawrence Markosian will facilitate the transition to the new lead.
- **Collaborators**: Ben Di Vito (LaRC), Martin Feather (JPL), Michael Hinchey (GSFC), Tim Menzies (WVU, IVVF), and Luis Trevino (formerly of MSFC).